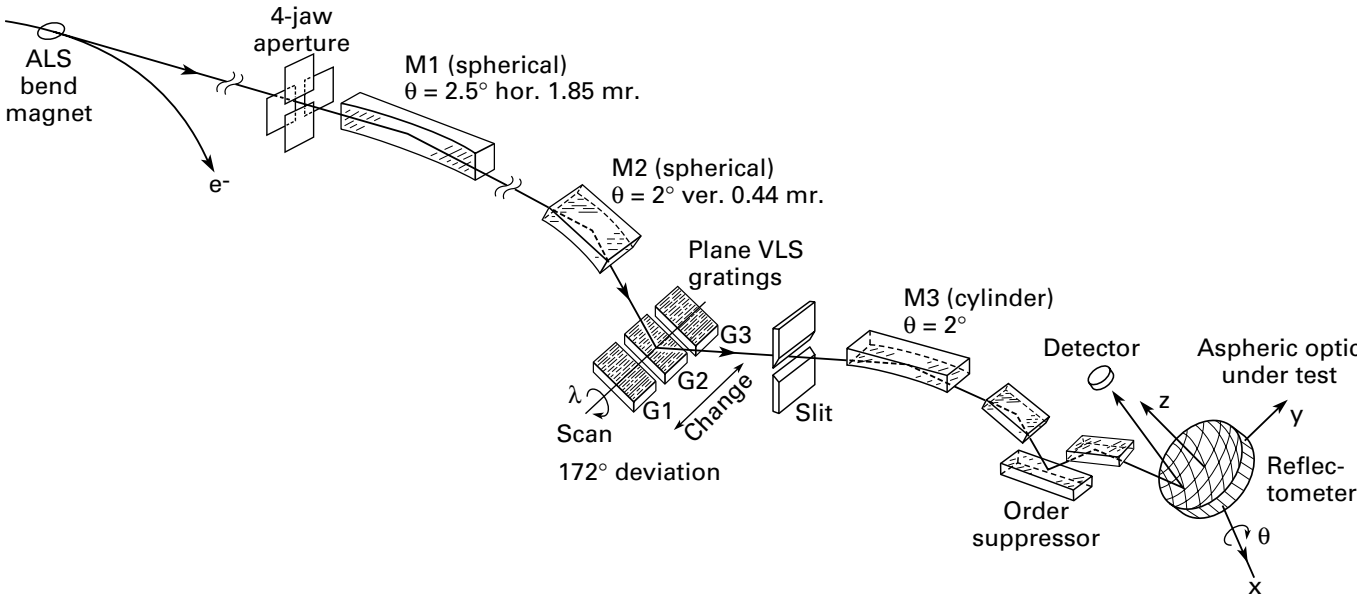
High-Precision EUV Calibration and Standards • Beamline 6.3.2

Berkeley Lab • University of California

Beamline Specifications

Photon Energy Range (eV)	Photon Flux (photons/s/0.01%BW)	Spectral Resolution (E/ΔE)	Spot Size (μm)	Availability
50–1300	10^{11} (at 100 eV)	7000	10 (v) × 300 (h)	NOW



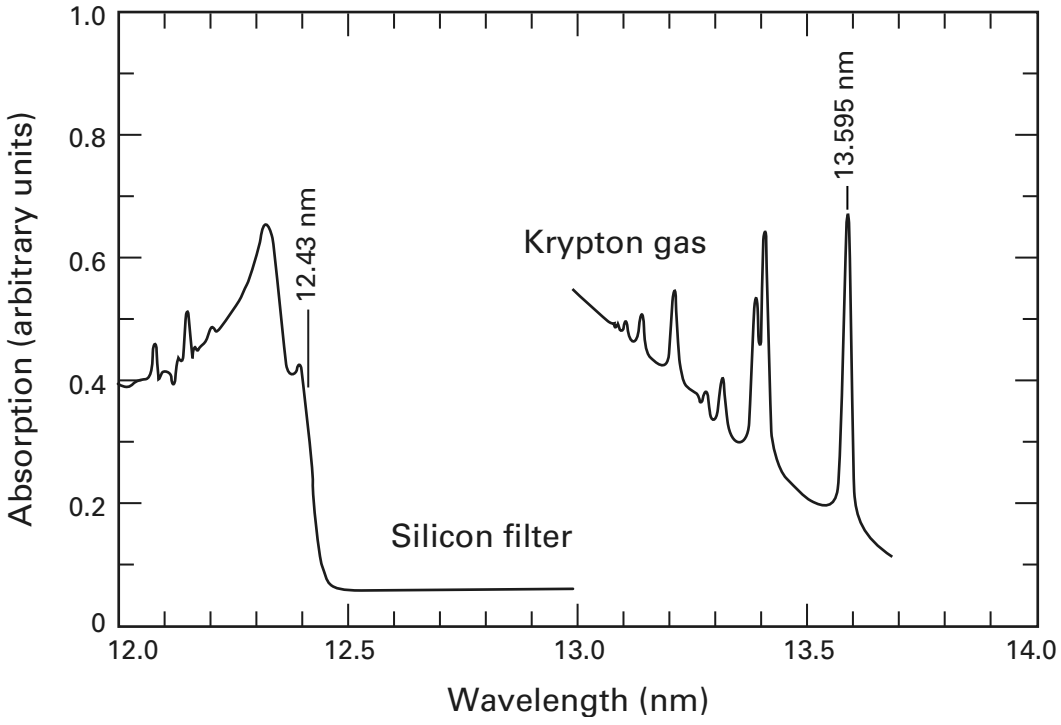
Schematic layout *of Beamline 6.3.2.*

Beamline 6.3.2 is a PRT-owned bend-magnet beamline dedicated to extreme ultraviolet (EUV) and soft x-ray reflectometry and scattering. The beamline is designed for high spectral purity and wavelength accuracy. Owned by the Berkeley Lab's Center for X-Ray Optics, the beamline is used for the characterization of optical components and reflective coatings for a variety of applications, including EUV lithography.

High spectral resolution is obtained using a variable-line-spaced plane-grating monochromator. The monochromator, designed and constructed by the Center for X-Ray Optics, has a very compact design with three variable-line-spaced gratings, no entrance slit, and a fixed exit slit. Entrance-slitless operation is possible because of the small size and high stability of the ALS beam. A vertically deflecting spherical mirror converges the EUV beam onto the monochromator grating. Aberrations of the mirror are corrected by the varied line spacing of the grating, so that the spectral resolving power of 7000 is determined primarily by the small size of the ALS beam. The wavelength is scanned by simple rotation of the grating with respect to the fixed

monochromator exit slit. The light is focused onto the sample by the first horizontally deflecting mirror and a bendable refocusing mirror downstream from the monochromator. High spectral purity is achieved using a combination of filters and a triple-mirror "order-suppressor."

A permanent reflectometer experimental station is available. A two-circle goniometer permits the sample to be positioned in three dimensions to a precision of 1 micron and its angular position to be set to 0.002°. Samples of up to 20 cm in diameter may be accommodated. An array of detectors including a photodiode, channeltron, and CCD camera are mounted on a rotating arm. Reflectometer performance specifications include high precision ($\Delta R/R \approx 0.2\%$) and high dynamic range (10^{10}). Space is available for additional experimental stations downstream from the reflectometer for a variety of applications, including spectroscopic studies in atomic, molecular, and materials science. Additional information is available at *www-cxro.lbl.gov/metrology*. ■



Absorption spectra of a silicon filter and of krypton gas *used to calibrate the monochromator wavelength. Data courtesy of E. Gullikson (LBNL).*

To obtain a proposal form, go to www-als.lbl.gov/als/quickguide/independinvest.html.

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